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EDITORIAL.

ROOT DISEASES AND THINNING-OUT.

WHEN undertaking a thinning-out programme on Malayan plantations, and especially so when such plantations are more than ten years of age, root disease becomes a matter of primary importance.

In all cases of careful examination carried out on local estates by this Department it has been found that the actual number of trees suffering from root diseases is considerably greater than would be suspected as a result of a superficial examination.

Considerable attention is being paid to the relative advantages to be obtained from a selective thinning-out of existing plantations and from the laying out of new plantations planted with budded stock from known high yielders.

The root disease problem makes contact at this point with these developments. It is a well-known fact that trees suffering from root diseases, *i.e.* White Ants and fungus attacks, are usually high yielders, and a careful examination of the roots of high yielding trees is absolutely necessary before using such trees as a source of bud-wood for vegetative propagation.

An endeavour will be made to show that, in Malaya, the available evidence is in favour of careful selection by thinning-out. There is little or no positive evidence regarding the yields to be expected from budded stock, and this must be left to the future. Even in this latter case the question of disease, in the form of Brown Bast, entering as a limiting factor in the question of yields per acre, has to be carefully considered; this is by far the most important aspect of the Brown Bast problem, and a considerable amount of experimental evidence is in hand to be published at a future date, supporting this contention.

The crux of the thinning-out problem is the response in increased latex yield, made by the remaining trees, to increase of space in which to carry out their normal functions. If satisfactory yields can be maintained or increased over a long period of years by a carefully considered thinning-out programme, it would be extremely

unwise to adopt other methods until such have passed beyond the experimental stage. Our experience has been that, given due regard and care in the early stages of the plantation, a satisfactory yield will be obtained and can be maintained or increased by careful thinning-out, without the risks of disease which would have to be met in any area planted widely originally.

The following table showing yields and thinning-out records is instructive (From a 67 acre block of rubber, planted in 1906, which has passed through the exhaustive tapping stage of the boom period; the estate is inland, soil considered of a good type for rubber growing.)

Yields are given for the periods 1st July—30th June—the financial year of the estate.

Year.	Month in which counts were made.	Trees per acre.	Total yield.	Approx. Yield per acre.
	Jan./14	120		
	May/14	62		
1914–15	...	„	16,606 lbs.	250 lbs.
1915–16	Sep./15	58	18,595 „	280
1916–17	...	„	21,203 „	320
1917–18	Oct./17	55	19,731 „	300
1918–19	May/19	42	17,467 „	260
1919–20	...	„	22,284 „	330
1920–21	...	„	22,329 „	350
1921–22	June/22	41	25,837 „	390
1922–23	...	31	*33,500 (estimated.)*	*475–500(estimated.)*

The records show a decrease from 120 eight—nine year old trees in 1914 to 41 sixteen—seventeen year old trees per acre at the present date. The thinning-out during 1917-19 from 55 to 42 trees per acre was done by first taking out alternate rows of eleven—twelve year old trees. The trees were left lying and fired in situ; the fire did such grave injury to the remaining trees that the advisability of clearing and replanting the whole area was under consideration. Fortunately this plan was not adopted. After clearing up the place, large numbers of trees with roots attacked by root diseases were unexpectedly found, chiefly a form of Brown Root disease which was entirely subterranean and could not be detected without digging well below the surface. These diseased trees were generally noticeable for their good yields but, in order to obtain a healthy stand and reduce to a minimum, the chance of losing further trees by disease, the roots of each tree were carefully examined by opening up the soil 8 feet around the tree to a depth of 18 inches. As a result the stand was finally reduced to 41 trees per acre.

The yield records require a few remarks. The yield for 1918-19 was low because during this period tapping was stopped for 1½ months. The tapping system from 1914—20th September 1919 was a quarter cut daily. From 20th September 1919 forward the tapping has been done on a single V alternate day.

During 1919-20, a policy of 50% restriction was inaugurated, but later the restriction was reduced to 25%. The manager's estimate for the ensuing year with 25% restriction is 475 lbs.—500 lbs. per acre ; during the last two months the yields have been well over the 500 lbs. mark.

This estimate for 1922-23 may be considered on the optimistic side, but the previous records clearly show increasing yields and with a large reduction in the number of trees per acre, there will be a corresponding reduction in costs. Though the estimated yields may not be obtained there is every indication that there will be a very substantial increase next year. The above records can be supported from many quarters. The following extract is from a report sent in recently from an estate in Pahang, on which the manager has carried out extensive yield determinations :—"Strikingly different figures have been registered from trees similar in age, size and general conditions, and these go to prove the absolute necessity of such a test before finally thinning-out mature areas of rubber. It will be at once realised that an estate yielding 400 lbs. per acre per annum is a sounder proposition than one with twice the number of trees and the same yield." "Some estates have gone so far as to cut out old rubber and replant with budded stock, holding that it is better to start afresh with known producers. Such action is unbusinesslike and unnecessary for there are good producers in plenty on most estates."

As careful and more extensive data are obtained, it becomes increasingly evident that the wisest policy to pursue is to work along the lines here indicated until such time as increased yields resulting from vegetative methods of propagation have been well proven. This waiting policy will not leave Malaya behind her competitors. Attention directed towards reducing costs of production of present supplies instead of increasing yields per acre will probably be more profitable in the long run. At least, it can be stated very definitely that little evidence has been collected, and less published, towards establishing the superiority as regards yields of trees planted from budded stock. Further, it is not unlikely that any considerable increase in yield of *Hevea brasiliensis* will result in new problems appearing which, until settled, will leave the rubber industry in much the same position as it now is.

A waiting policy is advisable but at the same time work on budded stock should be carried on in this country and results carefully checked, and compared with those in other rubber-growing countries. There is no doubt however, that a carefully checked thinning-out programme would improve the position of most Malayan estates ; yields could be kept up to standard even if no increase took place, and the reduction in cost per lb. would be substantial.

SELECTION OF COCONUTS.

By H. W. Jack.

THE days when rubber estates paid big dividends being now in the past, the thoughts of Agriculturists have turned to crops other than rubber, and coconuts, already well established in the country, are gaining more attention than heretofore. Coconut oil and vegetable oils in general, have sprung to a position of considerable importance in the world's economy during the last decade and the position has been decidedly enhanced since the war which, more than any other factor, proved the utility of vegetable oils.

The following figures clearly indicate the growth of the coconut industry in the Federated Malay States and similar increases occur in the Straits Settlements:

Copra Exports in the Federated Malay States.

		Total Value in dollars.
1904 ...	16,404 piculs. ...	—
1905 ...	30,172 „ ...	—
1906 ...	38,772 „ ...	—
1907 ...	49,326 „ ...	452,270
1908 ...	71,981 „ ...	462,870
1909 ...	106,469 „ ...	726,884
1910 ...	125,770 „ ...	1,194,226
1911 ...	135,064 „ ...	1,294,301
1912 ...	129,531 „ ...	1,303,169
1913 ...	156,038 „ ...	1,808,913
1914 ...	243,754 „ ...	2,474,990
1915 ...	234,150 „ ...	1,838,508
1916 ...	249,038 „ ...	2,141,739
1917 ...	353,722 „ ...	2,505,129
1918 ...	428,226 „ ...	3,053,325
1919 ...	447,717 „ ...	5,146,575
1920 ...	419,988 „ ...	9,216,586

The Officers of the Department of Agriculture have for many years recognised the importance of this crop which has always maintained a foremost place on their programme of work, more especially from the point of view of control of pests. The first enactment in any country which was passed to enforce coconut pest destruction was that of 1890 when the Government of the Straits Settlements gave powers to various authorised persons to order the destruction of pests and their breeding places. This enactment was followed in 1898 by a similar one in the Federated Malay States, and a special staff was organised to carry on a systematic campaign against the various pests of coconut trees. This campaign was eminently successful and saved the industry at a critical time when pests were very much in evidence. The present Inspection Staff continues this good work and has also

been instrumental in instructing all classes of cultivators how to deal most effectively with the various injurious insects.

The problem of the selection of seed coconuts has not been entirely neglected but no scientific breeding experiments have been carried on long enough yet to give definite results, but, experiments have been started in South India, the Philippines, Java and more recently in the Federated Malay States. In Java and the Philippines, selection has been restricted, as far as the writer is aware, to the identification, description and propagation of the best local varieties for special needs. Thus, in the Philippines some twenty-four types of coconuts are described, though only four of them are of considerable commerical importance as copra, toddy, or fibre producers and individual trees showing a notable development of one or other of these characters are selected as seed bearers for propagating the desired features. In the absence of prolonged scientific breeding work, this method of selection if carefully performed should produce good results, but the choice of parent trees is largely speculative for although the characters of the female parent can usually be ascertained yet, because its constitution is unknown, variation in the offspring is likely to occur to some degree in such a method of selection.

In South India work has been in operation for some years for the purpose of producing pure strains of various approved types of coconut for comparative trial as copra producers, etc., but this work is still in its infancy as the first generation of trees from known parentage has not yet reached maturity, as far as the writer is aware.

Some years ago the problem of coconut selection engaged the attention of the Botanical Division of the Federated Malay States' Department of Agriculture, and work, of a preliminary nature, was immediately initiated. Owing to the shortage of staff, scientific breeding experiments had to be postponed until very recently.

The purchase by the Government of Sapintas Estate, gave the Department an opportunity to begin experimental work on coconuts, and some 470 acres on this estate were assigned to spacing, covercrop, manurial and varietal experiments and for selection work. The seednuts for all the areas under spacing, covercrop, and manurial tests were obtained from one of the oldest and most uniform estates in the country. The collection of seednuts from such a realiable source constitutes the simplest form of selection and is one which should be adopted by every agriculturist in laying out any plantation.

Unfortunately, seednuts so collected are most frequently merely gathered from the piles of nuts accumulated at the store from an ordinary harvest, and nuts thus selected merely provide for the production of trees of average utility. A superficial examination of the individual trees on plantations grown from nuts selected in this manner reveals considerable variation in any character, girth, foliage height, colour, size and shape of fruits, number of nuts per bunch and per tree, length of spathe etc., so that this method of selection cannot be called satisfactory. Should the selection of seed-nuts be done in the

field by marking as parents individual trees which show desirable characters or which closely approximate to an approved type, a much more uniform plantation would be the result. This practice of picking out suitable parent trees does not insure uniformity in a plantation for not only do trees which look very much alike differ constitutionally but seedlings from the same parent tree will be found to vary to an extent, as yet undetermined, on account of cross-pollination which undoubtedly takes place, though not to the exclusion of self-pollination, as contemporaries maintain elsewhere; indeed, "selfing" appears to be the chief natural mode of pollination in Malaya. This has already been proved experimentally in the case of "dwarfs." (Vol. X, No. 1 of this journal).

Coconut trees like all other plants grown as mixed populations show variation in many characters, but the only character of economic importance is that of copra production. The number of nuts which a tree can produce is not a reliable index of its ability as a copra producer because consideration must be given to the size of the nuts, their shape, thickness of meat, etc., which are characters that vary greatly in different trees, but a study of the variation in the number of nuts produced by individual trees affords a glimpse of the extent to which variation occurs. A study of this nature, which has been in progress for a period of twenty-four months with 453 trees, shows a variation in the number of nuts produced per tree per annum of from 7 to 180. All these trees are about 12 years old and were taken consecutively in blocks of good average coconuts, that is, blocks which averaged upwards of 60 nuts per tree per annum, and the crops produced by each tree were recorded monthly. This study was taken up for the dual purpose of estimating individual tree variation and for selecting good trees as parents of seednuts for planting half-acre test plots, in order eventually to ascertain what percentage of the seednuts will prove true to the parent type and to compare copra yields of the progeny of different parent trees. Preliminary observations seem to indicate that at least 10% of the daughter trees will not come true to type. Similar variation in the amount of copra per nut occurs in comparing nuts from a mixed population, although in choosing nuts from trees of the same variety the variation is greatly reduced. The amount of copra contained in a nut is apparently a distinguishing character between different varieties of coconuts within limits, but young mature trees will yield slightly more copra per nut than old trees of the same variety.

It is a matter of concern with some owners and managers of long established estates that they find that a larger number of nuts is required to produce one pikul of copra than was required several years previously. This is the natural course provided that ordinary cultural methods are maintained and is no cause for alarm, unless the difference becomes extremely great. Mention is made of this matter, because some planters are inclined to select seed-nuts on the basis of the number of nuts required to produce one pikul of copra. This method of selection is erronious because the essential concern on every coconut plantation is the amount of copra which each acre can produce, it matters little whether 200 or 220 nuts are required for the preparation of one pikul of copra as long as the total output per acre

is high. Of course the question of cost of handling nuts must be considered but when differences of only 20 or 30 nuts per pikul are involved the costs are not materially affected. Sound selection can only be based on the amount of copra produced per tree under estate conditions. For this method of selection it is necessary to study the producing qualities of individual trees and by a process of elimination to ascertain which are the best trees on the estate. This cannot be done in a short time nor can it be done economically over large areas, but the best producing field of each estate should be chosen for selection of seednuts, and a block of, say, 40 acres in that field should have every tree numbered and a record compiled of its yield of nuts per picking. Three one monthly pickings will be sufficient to indicate the poorest trees which can then be dropped out of the experiment, thus reducing the task of record taking by one-third. Records of the number of nuts per picking from the remaining trees should be kept for a further twelve months and then calculations should be made to show which trees produce the most nuts per annum. Having ascertained the best trees from the point of view of number of nuts produced, the next step is to compare the amounts of dry copra produced by the nuts of each tree. For this purpose as many ripe nuts as possible should be taken from each of the best trees, taking care that the nuts from all the trees in the comparison are, as far as can be discerned, equally ripe. The nuts from each tree should be carefully converted into dry copra in separate lots and weighed and then a calculation made of the amount of copra produced per nut from each tree. The best trees having been determined, it is now necessary to examine their individual environments for should any of them occupy especially favourable positions with regards to light, drainage, etc., they should be discarded, because their high productivity, which may, with certainty, be partially ascribed to their favoured situations, might fall very low under normal estate conditions. Finally, only trees which appear healthy in every respect and as nearly the same type as possible should be chosen, and the number selected should depend on the size of nursery required. In a block of 40 acres, say 1,900 trees, it should be possible, under average estate conditions, to find 100 trees capable of producing over 110 nuts per tree per annum, which would be sufficient to supply 900 nuts per month for the nurseries. As already stated, many seednuts so selected will not produce trees true to the parent type, but this method of selection is the only pratical one for the planter to adopt.

The production of pure strains of coconut, which is the only certain method of producing uniform and high yielding estates, lies beyond the power of the planter, because it necessitates initial work stretching over at least three generations of trees, but this work has recently been inaugurated by the Department of Agriculture and will, it is hoped, be continued to a successful issue.

The type of coconut to select for future plantations would appear to be a medium sized rounded nut. Large nuts are generally produced in small numbers and oblong nuts on the average contain less copra per nut than round ones. At the same time, it is quite possible that exceptional trees, which bear large numbers of large nuts, may be found and, if so, they should of course, be selected as parent trees for

some of their offspring are sure to inherit the parental heavy yielding characters. The above remarks refer entirely to tall coconut trees (as opposed to dwarf) but a few words about dwarfs will not be out of place. So far, none of the types of dwarf trees has been encouraged in India, Ceylon or Java, where coconut cultivation has been so long in vogue. In Java the orange type of dwarf is said to be the only one which produces nuts in anything like sufficient numbers to enable it to compare with tall trees as copra producers per acre, taking working costs into consideration, but this assertion needs investigation. The manager of a local estate contends that a certain type of dwarf (niyor gading) is capable of producing far more copra per acre than is produced by average tall trees. He has planted large areas with this type of nut and the development and output of the areas will be watched with considerable interest. Also shipments of these nuts have been sent to Ceylon, Burma, Java, and India for comparative trials in those countries, in which the "niyor gading" may not have been known authoritively, previously. With regard to dwarfs, Copeland, in the Philippines, says "the difference in economy in handling large nuts and small nuts is so great that even though one of the dwarf nuts which, in general, mature several years sooner than the large nuts do, were approximately equally productive with one of the very large varieties it would still in the long run, not be economical to select the dwarf nut for the manufacture of copra." Apparently he has had no experience of dwarf trees which yield more copra than tall trees, but apart from his reason for the discouragement of planting dwarf trees, there are grounds for believing that their life period is limited as compared with tall trees and that their particular advantage lies in the fact that they give a more rapid return on capital expenditure. Of course, as our knowledge of dwarf trees increases, it may be found economical to plant them and when they begin to decline, to cut them out and replant but this largely depends on the yields obtainable from mature trees.

Observations regarding types, growth, pollination, production etc. of dwarf palms are being recorded and will be communicated in the pages of the Malayan Agricultural Journal from time to time.

With regard to the possibility of selecting types of nuts by the quality of oil they contain, experiments by the Chemical Division seem to indicate that the oils contained in different types and varieties of nuts do not vary to any appreciable degree and certainly not to an extent likely to affect the market price of oil derived from different varieties.

Over seventy parent trees have been selected as probable heavy yielders by the Botanical Division, the selection in some cases being based on yield data extending over more than a year, but most of the trees were selected by field examination. A sufficient number of seed-nuts has already been collected from most of these trees to plant up half an acre of each for comparative yield trials of blocks and of individuals on attaining maturity as a basis for seed selection. Many of these lots have already been planted out in the field and care is being taken to give them good average cultural conditions.

In addition to work regarding the selection of heavy yielding strains of coconuts, a study of the different types of coconut grown in Malaya and elsewhere is essential, in order that the experimenter may become expert in picking out and describing the different characters of importance for the accumulation of data which may give clues to correlation and variation factors, and to throw light on the capabilities of different varieties, etc. For a comparative study of this nature, the Botanical Division has collected seed-nuts of eighteen distinct types of coconuts representing local varieties and has imported seed-nuts from most coconut producing countries and planted them in blocks on Sapintas Estate. These importations which should prove interesting in about five years' time include types from Borneo, Java, Ceylon, Seychelles, South India, Cocos Islands, Panama, Burma, Madagascar, etc. The scope of coconut work is wide and the many problems it presents other than those connected with selection work, are interesting. It is hoped that the gradual development of the Government Experimental Coconut Estate will do much in the next decade to clear up some of the more pressing problems connected with this useful and profitable crop.

OIL EXPELLERS.

By B. J. Eaton.

IN continuation of the information on the Anderson Oil Expeller published in the Agricultural Bulletin Vol. VII (1919) No. 1 pages 9 and 13, the following additional information on Oil Expellers may be of interest.

Anderson Oil Expeller.

The Anderson Oil Expeller is used for expressing copra in Ceylon, and in mills visited by the writer in Colombo in May 1921, satisfactory results were being obtained. The copra was crushed or broken into small pieces and heated in preliminary hot air drying chambers before being treated in the Expellers.

During a recent visit to a large copra oil mill in Singapore the writer also saw a battery of five of these machines in operation for the first pressing of copra and the engineer in charge of the mill expressed his satisfaction with the results obtained. In this mill however copra is normally pressed twice in hydraulic cage presses and the Expellers are now substituted for the hydraulic presses formerly used for first pressing.

These machines, equipped with pulley on side for belt drive, foots elevator, stationary strainer, tempering apparatus and shaker feeder, were quoted at $13,000 (Straits) F. O. B. Singapore in the latter part of 1921.

Motors of 15 and 20 H.P. for driving the Expeller were quoted at $2,700 and $3,000 respectively. If electric current is not available, the Expeller can be driven by other power.

Smulders Oil Expeller.

Automatic Expellers have also been constructed for some years by the firm of Franz Smulders, Utrecht, Holland, who have forwarded details in respect of their machines. This firm states that over 400 of these machines are working in Holland and the East Indies and giving satisfaction.

It is preferable in making enquiries from the firm in respect of the machines to state the type of seed which it is proposed to express and the quantity per unit time with which it is proposed to deal.

The chief advantages of this machine, as in the case of the Anderson Oil Expeller, are low cost, small space occupied, little or no foundations required and few workmen for operation.

The following estimates have been quoted by this firm :—

Distribution heated kettle ...	260 guilders.
Expeller	7500 ,,
Set of spare parts	850 ,,
Packing extra	6 per cent.

The Expeller (Type B) for copra, is supplied with tempering apparatus 12 feet long, working at a maximum steam pressure of 45 lbs. per sq. inch, return conveyer, set of tools for each set of four expellers or less (including ratchet wrench, socket wrench, bar lifter, screw driver and car wrench) and condensing vessels for each expeller.

The set of spare parts includes one quillworm, one threaded spacing collar with bronze ring, one cone point, three discharge worms, three worm spacing collars, half a set of steel bars for press cage, (88 bars) and two anti-turn bars.

Additional plant required :—In addition to the necessary Expellers to deal with the output of a factory, a boiler, engine or motor, crushing rolls and filter press are required, in addition to the necessary belting, piping, storage tanks and container for oil.

(Ref. D. A. 899/21.)

BOTANICAL NOTES ON THE BRAZIL NUT TREE IN MALAYA.

By W. N. Sands.

IN the Garden's Bulletin, Straits Settlements, Vol. II, No. 12 of August 1921, there is published an article by G. B. Deshmukh on the fruiting of the Brazil-nut-tree in the Singapore Gardens. The Singapore plants were introduced from Kew in 1881, and observations were made on these in order to ascertain whether the trees belonged to the species *Bertholletia nobilis* or *Bertholletia excelsa*. After reviewing the literature on the subject, the writer points out that the Singapore trees would fall into the species *Bertholletia nobilis* and not *Bertholletia excelsa* if Young's description of the fruits in the Botanical Gazette was relied on; whereas if Miers' description of these two species of *Bertholletia* in the Transactions of the Linnean Society was followed, certain of the characters would be those of *Bertholletia nobilis*, and others of *Bertholletia excelsa*. The conclusion arrived at, however, is that the Singapore trees belong to one species only.

As mentioned in the article by J. N. Milsum in Vol X No. 3 of the Malayan Agricultural Journal, a consignment of Brazil nuts was received from Kew in 1912, and fifty seedlings were planted out in the Kuala Lumpur Experimental Plantations. The trees have grown particularly well and two of the largest recently flowered and fruited.

As these trees are derived from a much later importation than the Singapore trees referred to above, it may be useful for reference purposes to add notes concerning their vegetative, flowering and fruiting characters.

The vegetative characters of all the trees indicate a common origin and no variation has been observed in them.

Leaves.—10—12 inches long, $3^1/_2$ to $4^1/_2$ inches wide, alternate, exstipulate, oblong, pointed, sub-coriaceous, glabrous, shiny dark-green above and dull lighter-green below; rufescent when young; margins minutely serrate; petioles short, $^1/_2$ to 1 inch long, stout, deeply channelled along the upper surface.

Inflorescence.—Large panicle, 10—14 inches long, chiefly terminal on branches at, or near, the top of the tree. Smaller inflorescences sometimes arising below the chief terminal one. Primary branches 2 to 6, at first horizontal, and then becoming erect. In large panicles a few secondary branches. Flowers opening in centripetal order (racemose).

Bract.—Light-green, cuncate, concave, caducous.

Bracteoles.—2 light-green, concave, half covering young flower-buds, caducous.

Flower.—Large, $1^1/_2$ inches in diameter, hermaphrodite, peduncle short, stout, $^1/_8$ inch long.

Sepals 2, epigynous, joined together in young buds but splitting apart as flower expands, tridentate, yellowish-green, tube adnate.

Petals 6, polypetalous, imbricate, unequal, recurved, fleshy at base, creamy-yellow.

Stamens numerous, fertile and sterile. Fertile small, closely packed together forming a corona on a fleshy urn-shaped disc; filaments short, swollen towards apex: anthers lightly attached and dehiscing longitudinally. Disc extended on its lower side into a tongue-shaped body, $^3/_4$ inch long and $^3/_8$ inch wide, tinged with magenta on inner surface, and terminated by a large smooth creamy coloured globular mass containing sterile stamens or staminodes. The tongue-shaped extension of the disc with the staminodes is tightly incurved and pressed upwards against the fertile stamens which fit closely into a groove which runs along the upper and inner surface of the globular body. Staminodes shortly stalked, yellow, about $^1/_2$ inch long. The tongue shaped portion of the disc bearing the staminodes acts as a spring which only a heavy bee such as the Carpenter bee, (*Xylocarpa* sp.) can depress and in so doing gain access to the interior of the flower.

Carpels 4, loculi 4: style longer than fertile stamens, recurved; stigma capitate ovary inferior top slightly depressed with numerous small ridges radiating from the base of style; ovules few in each loculus; placentae axile.

Fruit.—Large spherical pyxidium, about $18^1/_2$ inches in circumference, and $5^3/_4$ inches in diameter, rough, surface densely lenticellated: at apex a circular depression about 3 inches in diameter, with opercular opening approximately central. Wall of fruit $^{13}/_{16}$ inch thick of which the outer cortical layer is $^5/_{16}$ inch and the inner hard woody portion $^3/_8$ thick; outer layer cracks with age but does not peel off. Opercular opening $^1/_4$ inch in diameter widening inwards to $1^1/_4$ inch at base. Operculum large, conical with a short point; attached to columella and eventually falling into the cavity of the fruit. Nuts about 16,* triangular, $2^1/_8$—$2^1/_2$ inches long, side $1^1/_8$—$1^3/_8$ inches, middle of back, $^6/_8$ to $1^1/_4$ inches.

It should be mentioned that the above description of a fruit applies to a typical specimen from one of the trees. Some variation

* The average number of nuts was 16 in the ten fruits examined.

was observed in the size and shape of the fruits from the other tree ; these were smaller and somewhat elongated, the nuts, also, were not as large, but the other botanical characters were similar. Further as previously mentioned no variation could be detected in the trees which have not yet fruited, therefore the writer considers that the Brazil-nut trees growing in the Kuala Lumpur Plantations belong to one species only and until the matter is definitely settled by the Kew authorities this may be either *Bertholletia excelsa*, Hump and Bonpl, or *Bertholletia nobilis*, Miers.

CHEMICAL NOTES.

By B. J. Eaton.

Slab Rubber.

TEN tons of slab rubber which, after maturation, is creped and dried on the estates, is being exported by a well known group of estates in the Federated Malay States. Latex containing over three pounds of dry rubber per gallon is used and the latex coagulated in tanks in pieces of suitable thickness for handling on the crepeing machines by removing every alternate division board in the tanks.

The slabs are matured in smoke houses at ordinary temperature *i.e.* no fires are used in the smoke houses. The resultant crepe is of good even appearance and has a drab colour. The final dried crepe is practically odourless.

An enquiry has been received by another estate for this type of rubber.

Preservation of Latex.

A number of enquiries has been received as to the most suitable method of preservation of latex for shipment to Europe and America. At present the addition of ammonia in the form of Liquor Ammon Fortis (the most concentrated solution of ammonia on the market) is being recommended. Two per cent. of Liquor Ammon Fortis calculated on the volume of latex is recommended or approximately $3^1/_4$ ozs. per gallon of latex. In order to save freight the latex should be as concentrated as possible and, except on a rainy day, it should be possible to collect and ship latex containing from 2.5 to 3.5 lbs. of dry rubber per gallon.

In considering the prices offered for such latex, sellers or producers should ascertain the dry rubber content required as the price offered should be higher for concentrated latex of a high rubber content.

Experiments are being carried out to ascertain the possibility of substituting preservatives other than ammonia, since this chemical is expensive. The present price in England is about $6^1/_2$d. per lb. or 4 9 per gallon, so that the quantity recommended would cost about 1d. per gallon of latex. The total cost of ammonia however is considerably higher, as the freight on this chemical is high.

It should also be pointed out that drums of Liquor Ammon Fortis should be handled with great care and the stoppers should be removed in the open. The operator should also be careful not to stand over or hold his face directly over the containers when removing the stoppers. The strong solution is saturated in temperate climates

and is supersaturated in tropical temperatures, so that there is considerable pressure in the bottles and frequently, on removing the stoppers, the whole of the contents may spout as a fountain and blind the operator.

It is possible that steel cylinders of compressed ammonia, which can be imported, may prove more economical than the importation of Liquor Ammon Fortis but the addition of the ammonia gas to latex from such cylinders requires controlling by a skilled operator. Automatic pressure gauges may be purchased in England to deliver the gas at a definite pressure but the quantity released at a definite pressure over a given period would have to be measured by absorption and estimation.

Preserved latex can be shipped in clean sealed kerosene tins, preferably packed two in a wooden case, or in drums.

The use of preservatives or anti-coagulants such as soda or sodium carbonate will depend partly on the use to which the latex is applied and its subsequent treatment. If subsequently coagulated by acidification, an alkali such as sodium hydroxide or carbonate will probably be quite suitable but free alkali in rubber causes deterioration and produces a tacky product.

Desiccated Coconut.

An article containing more details in respect of the machinery and methods employed for the manufacture of desiccated coconut has been prepared for publication and experiments on methods of preparation of desiccated shredded coconut and of other coconut products in sealed tins are being carried out.

It has been found that the dried shredded material cannot be preserved locally in cardboard packets enclosed in tracing cloth and carefully waxed. This means that sealed packets, e.g. lead lined boxes or sealed tins are necessary for export.

It is of interest to note that a factory has already been erected near Butterworth for the manufacture of desiccated coconut.

Nipah Palm.

Tapping experiments on the Nipah palm are being continued but the results obtained are not sufficiently complete or extensive to enable definite recommendations to be made.

It is not possible to ascertain the age of any of the palms, either on indigenous or planted areas.

Two plots, one near the coast and one inland, have been selected for planting and tapping operations, although it will not be possible to tap palms planted from seed till the third or fourth year after planting.

A paper containing the results of available information has been prepared.

Inventions.

New Preparation of Rubber.—A promising invention in connection with a new method of preparation of raw rubber has been patented recently.

This consists of a method of preparing a product which may be described as "whole" rubber or desiccated latex, which contains all the constituents of the latex.

Latex is impinged from a jet on a rapidly rotating disc from the edge of which it is thrown off in a fine film or spray into a chamber into which hot air or other hot gases are passed. The fine particles of latex are thereby dried in the form of flakes or powder which can be pressed and shipped in blocks.

Vulcanised fibres.—An invention has also recently been patented for the absorption of rubber or fibres by treatment with latex. It is stated that fibres will absorb much larger quantities of caoutchouc or rubber when thus treated than by dipping or treating the fibres with a solution of rubber in a rubber solvent. This process may be of value in the preparation of fibres, cords, canvas, etc., for tyre and other manufactures.

PRELIMINARY NOTE ON THE "LESSER" COCONUT SPIKE MOTH.

By G. H. Corbett.

A NUMBER of enquiries has been received with respect to the importance of this insect as affecting the yield of coconuts and it is considered that a brief résumé should be given. Investigations of this insect have only recently been commenced and, as they continue, data may be found and observations made which may qualify some of the statements in this preliminary note.

Local History.

At the Malaya-Borneo Exhibition held at Singapore this year, amongst the entomological exhibits were specimens of coconut spikes, which aroused considerable interest, showing injury caused by the caterpillars of the "Greater" Coconut Spike Moth.

Later, the writer visited an Estate in Perak to report on an area of coconut palms, which, though producing healthy spikes, failed to set a large number of nuts. During this visit, caterpillars of the "Greater" Coconut Spike Moth and of the "Lesser" Coconut Spike Moth were found.

Owing to the caterpillars of the "Greater" Coconut Spike Moth not being observed on a tree producing no nuts an unopened spike was cut down. On examination whitish coloured cocoons were seen together with injury not only to the male but also to the female flowers.

Proceeding to the area of coconuts not yielding as well as other areas, further examinations of coconut spikes, especially those about to burst, were made, and in the majority or cases, caterpillars as well as pupae in cocoons together with signs of injury to both male and female flowers were in evidence. From two of the spikes opened a number of moths escaped.

As far as the writer is aware injury caused by the caterpillars of the "Lesser" Coconut Spike Moth to the flowers of the inflorescence, whilst still enclosed within the spathe, has not been previously recorded.

Economic Importance.

From field observations and examinations of spikes in the laboratory this insect would appear to be the principal pest of coconut spikes, as a large number of female flowers are found to be injured before the spikes have opened.

Two consignments of unopened spikes forwarded to the Department of Agriculture from an Estate showed the following results when opened :—

Total number of spikes	...	15
Do. injured female flowers	...	156
Do. uninjured female flowers	...	71
Percentage of injured female flowers	...	68.72
Do. uninjured female flowers	...	31.27

It should be stated that the percentage of injured flowers might have been greater if the spikes had burst of their own accord.

It is considered probable that damage to the inflorescence caused by this insect at such an early stage may prevent the female flowers maturing, for the following reasons :—

(1) Male flowers attacked frequently turn black and this discolouration would appear to continue down the stalk resulting in the dropping of many flowers.

(2) Female flowers are frequently noticed with a jelly like substance over their surface and it is possible that these will not open to allow of pollination, with the result that fertilisation does not take place.

(3) Female flowers having their scales and surfaces damaged by the caterpillars are liable to be exposed to bacteria and fungi with the ultimate non-setting of nuts.

Experiments are being conducted in the field in order to ascertain if injured female flowers can produce mature nuts, if uninjured female flowers on a damaged spike reach maturity, and if all female flowers on an undamaged spike reach maturity. Until results from these experiments have been obtained definite statements in connection with the importance of this insect cannot be made.

It should be stated that the writer has found the caterpillars of this moth on trees which were considered bearing well.

Distribution.

This insect has been found in Perak and Selangor and is probably distributed throughout Malaya.

Injury to the Flowers in the Spike.

Frequently when the spathes are cut open injury is not observed but by taking the inflorescence out of the spathe damage, confined essentially to the inside of the flowers, is noticed.

The damage is chiefly seen on the flowers at the basal half of the spike but the marks showing where the caterpillars have entered through the spathe are generally found at the apical half. This peculiarity is probably due to the growth of the spike after infection.

Brief Description and Life Cycle of the "Lesser" Coconut Spike Moth.

In the laboratory preliminary observations show that the eggs of this insect are laid on the spathe generally between the grooves where the tissue at the base is softer than at the surface. The egg is small, oval, and yellowish white in colour, and when about to hatch the caterpillar is seen doubled up inside it. The eggs hatch in from two to three days and the caterpillars boring through the spathe feed upon the flowers. The caterpillar is at first white in colour with a dark brown coloured head and with pale brown coloured bands between the segments. Before pupation the bands are greenish in colour and the larva measures about 8 mm. in length. The larval stage lasts from 5 to 8 days. When full grown the caterpillars pupate in white elongated cocoons generally at the base of the main flower stalk.

The pupal stage lasts from 6 to 8 days.

The moth has a wing expanse of 11 mm. Length at rest about 6 mm. The fore wings are light brown with small black spots. Both pairs of wings are fringed. The male is slightly smaller than the female.

Summary of Life Cycle.

	Minimum.	Maximum.
Egg Stage	2 days.	3 days.
Larval „	5 „	8
Pupal „	6 „	8
Total ...	13 „	19

Mention may be made that figures so far obtained of the life cycle of individuals indicate that the minimum length of time is 15 days, and the maximum 17 days: the majority 16 days.

Time Spikes Attacked.

In field observations on coconut trees carrying three unopened spikes, the youngest spike has not been noticed attacked, the middle spike shows slight feeding marks and spots on the inside of the spathe are conspicuous, whilst the oldest spike sometimes possess caterpillars pupae, and moths, but cocoons with pupae inside them are mostly in evidence.

From the study of the life cycle, and observations in the field, the eggs in nature would appear to be laid about fifteen days before the bursting of the spike, so that treatment to prevent either eggs from being laid or the caterpillars entering the spike should be done before the spike is more than half grown.

Control.

Control experiments are taking the form of (1) injecting substances into the spike, (2) spraying spikes with poisonous substances

and (3) painting the spathe with probable deterrents to the moths and substances affecting the eggs.

The writer is not at present in a position to give recommendations for the control of this insect. If this insect proves of importance, investigations and field observations will continue. Definite control measures may not be forthcoming for a considerable time, but injections with carbon bisulphide appear to cause too much damage to the inflorescences to be recommended as a control measure.

Note.—Besides the "Greater" Coconut Spike Moth another species of moth has been bred from opened spikes.

The three species of moths obtained from the spike have been forwarded for identification to the Imperial Bureau of Entomology.

Since writing the above the "Greater" Coconut Spike Moth has been identified by Dr. Guy A. K. Marshall as *Tirathaba* sp., near *trichogramma*, Meyr, and was unrepresented in the British Museum.

NOTES ON SISAL HEMP AND BOWSTRING HEMP.

THE following information in respect of Sisal Hemp (*Agave Sisalana* and Bowstring Hemp (*Sansevieria spp.*) has been received from the Directors of Agriculture, Kenya Colony and Tanganyika Territory in reply to enquiries addressed to them.

Sisal Hemp :—This plant is usually planted 8 ft. x 8 ft. or 680 plants per acre.

The plants usually pole in 5 to 7 years according to locality in Kenya Colony and give the following yields :—

YIELD OF LEAF PER PLANT.

	1st Class leaves.	2nd Class leaves.	Total.
3rd Year ...	37	58	95
4th „ ...	28	42	70
5th „ ...	22	30	52
6th „ ...	18	25	43
Total ...	105	155	260

Average weight of leaf, 10¼ ozs.

Average fibre content 3.6 per cent.

Yield of fibre per acre is about 2¼ tons spread over the 3rd and 6th years.

The fibre is exported to Great Britain and Ireland.

Sansevieria :—This fibre plant is grown only under jungle conditions and the following varieties are known in East Africa-*Sansevieria Ehrenbergii* and *Sansevieria Sulcata*. It is not cultivated in Tanganyika Territory also, but is found in many parts. The fibre is not extracted as a commercial product but to a small extent by natives for domestic use. Its cultivation was attempted by the Germans but given up as unprofitable.

Europeans have also paid little attention to this plant in Kenya Colony owing to its slow growth and poor market prices. Attempts were made to ret it and to pass the fibre through machinery used for the decortication of Sisal Hemp but with unsatisfactory results. Natives on the Coast treat the leaves by beating, then retting for a day or two, and after further beating, wash out the fibre.

B. J. E.

NOTE ON JUTE AND GUNNIES.

(Abstract from Supplement to the "Indian Trade Journal," April 30, 1920 by J. C. Nixon, I.C.S. D.A. 831/22.)

THERE are two main species of Jute grown in India, *Corchorus capsularis*, with rounded capsules, and *Corchorus olitorius*, with long cylindrical capsules.

The former is the hardier species and in contradistinction to the latter can withstand submersion in water up to its middle when only half grown. *Corchorus capsularis* is also superior in colour and fineness and is less brittle, though it is usually inferior in length. *Corchorus olitorius*, however, though coarse, gives an excellent spinning fibre. Each species has early and late varieties, the latter yielding generally a heavier outturn.

The land is prepared by five or six ploughings just after the first shower of rain in the latter part of February or early March. Sowing extends from the middle of February to the end of May or even into June, but on low lands, liable to flood, sowing must be finished by the end of March. When the plants are 6 inches high a rake is drawn over the land two or three times for the purposes of thinning out and of loosening the earth. This process is not continued after the plants have reached a height of one foot. The seeds germinate in 2-4 days and the plants mature in from 12 to 15 weeks.

Jute is cut from the beginning of July to the end of September and sometimes in October. The bulk of the crop is harvested in August and early September. The jute season is reckoned from 1st July to the following 30th June.

The jute fibre is contained in the bark and is associated with a gummy pectose, this has to be softened by a fermentation process. The stems are freed from leaves and side branches and the resulting long wands are tied into bundles, which are occasionally stacked for two or three days. They are then kept under water for usually from 10 to 12 days but occasionally for as long as a month. The process is called steeping or retting. The fibre must be separated from the stem within a couple of days after the retting is complete. The methods employed for this purpose are :

1. To take each stem separately and strip it by hand.
2. To beat a bunch with a wooden mallet.
3. To dash a handful on the surface of water.

The separated fibre should be washed in clean water, if possible. The water is wrung out of the fibre which is then thrown down to dry and bleach in the sun for two or three days. The usual length of the fibre is six to nine feet, if it is below six feet it is called short. For purposes of forecast the yields are reckoned at from 1,200—1,500 lb. per acre.

Jute comes into commerce in the following forms :—

1. Loose Jute.

   (*a*) In drums weighing 30 – 40 seers each (60 – 80 lb.) and roughly assorted:

   (*b*) In 'kachha' bales weighing about 1½ maunds (about 123 lb.) assorted and hand-pressed, or 3½ – 4 maunds assorted and power-pressed.

2. Baled, *i.e.* as 'pakka bales' each weighing approximately 400 lb. and pressed in a hydraulic press to occupy about 10$^{2}/_{3}$ cubic feet.

Jute goes to the local mills in any of these forms but usually as kachha bales. It is exported to foreign destinations only in the form of pakka bales. The pakka baling presses are mostly in Calcutta but there are some at Dacca, Chandpur, and Narainganj. Kachha baling presses exist all over the jute area—Bengal, Assam and Behar and Orisa.

In the loose state jute is usually known according to the locality in which it is grown or rather according to the local market in which it is sold. In the local market it is bought by weight according to the local maund. It is brought to market in bundles of which the size and weight vary from locality to locality.

In use, jute is classified as follows :—

1. *Hessian warp* which is strong, healthy and fine jute of good gloss and silvery white colour with no specks or sticks in it. It is used for spinning thread which is suitable as warp in weaving hessian cloth.

2. *Hessian weft* which is inferior to hessian warp in colour and gloss but is otherwise similar. It is used as the weft in hessian cloth.

3. *Sacking warp* which is strong and healthy jute, irrespective of colour and coarser than (1) or (2). The thread spun from this is used as warp in weaving cloth for the manufacture of sacks and bags.

4. *Sacking weft* is composed of the dull coloured, short or weak jute remaining after the three grades above enumerated have been selected from the bulk. This jute is used in the manufacture of cloth for the heavier grades of sacks and bags. The term sacking weft may generally be taken to include :—

   (*a*) *Rejections* which are either damaged or barky or knotty. Rejections have to be particularly well batched before they can be used even for the inferior cloths.

(*b*) *Cutttings* represent the jute cut off from the ends either at the time of assorting pakka bales for shipment or when selecting jute at the mills intended for the manufacture of hessians and the better grades of sacking goods. Clean workable cuttings are largely used in the preparation of sacking warp while the inferior low grades are commonly utilised for paper-making.

In practice there is no hard and fast line between any successive pair of the above four groups.

In Loose jute the cuttings are always still attached to the main fibre. It is quoted by the Calcutta Bazar maund which is equal to 82 lb. 1 oz. 9 dr. In contracts it is usual to specify to probable yield of the bales, thus—

.....per cent. good hessian warp

.....per cent. good sacking warp

.....per cent. weft and cuttings

Drums and bales are divided into.

1's containing all hessian warp (in the trade these are practically unknown).

2's containing 20% good hessian warp, 60% good sacking warp and 20% weft and cuttings,

3's containing 70% sacking warp and 30% weft,

4's containing 40% sacking warp and 60% weft

Rejections are usually marked R's and a reliable packing usually containins 20% sacking warp.

These different qualities are sometimes represented by letters instead of by figures and sometimes intermediate numbers are given.

As a matter of fact these classifications are largely theoretical. Formerly the system may have held but most balers now sort and bale according to their own special standards to which they give numbers. The best that can be said of a particular number is that a 2 is better than a 3 and so on and that the reputed 2 of a well known baler is never inferior in its yield to the theoretical 2.

The standard quality of the loose jute market was formerly 50/50 meaning that 50% of the bales were 2's and 50% 3's. 50/50 when quoted at the present time more usually means 50% 3's and 50% 4's. The standard quotation of the present time is, however 1's. The standard of the grades is improving yearly, so much so that a 3 of to-day is as good as a 2 of a few years ago.

Baled jute is quoted by the bale of 400 lb. nett or including tare 405 lb. For the purpose of freight calculation five bales are guaranteed to occupy not more than 52 cub. ft. per ton at the time of delivery from the press house and not more than 54 cub. ft. per ton alongside the exporting vessel. In the case of 'pakka' bales there are various grades, the packing of which is carried out to regulated standards of quality recognised in the local and overseas markets.

As in the loose jute market, the quality of a particular baler's particular mark becomes known apart from any alleged grouping and it is bought on its reputation, although in contracts for the supply of pakka bales to jute mills it is not uncommon to guarantee certain percentages, say of Hessian warp and Sacking warp.

It is interesting to note the number of hands through which the marketing of jute passes or may pass:—

1. The cultivator or raiyat who produces it. He either brings his jute to the local market and sells it, or very frequently sells it while the crop is on the ground, receiving either the whole or part payment in advance.

2 & 3. The 'Vepari' who acting as buying agent for the 'mahajan' and with money advanced by the mahajan without interest bargains with the raiyat for the purchase of the jute and pays ready money for it.

4. The mahajan either sends his goods in drums to an 'arathdar' in Calcutta or makes them over to an arathdar in the local markets. The arathdar has a godown. He ordinarily does not purchase the jute, but acts as commission agent between mahajan and baler. He charges commission and godown rent and is responsible for the recovery from the baler of the price of the goods sold.

5. The baler, kachha or pakka, who bales the jute in a press.

6. The underbroker who offers on behalf of the baler the baled jute to the broker.

7. The jute broker who finds buyers who may be mills or shippers or pakka balers.

8 & 9. The shipper who ordinarily does not possess his own ships and arranges shipping space through a freight broker.

10. The foreign purchaser or the jute mill.

In actual practice many of these links are omitted.

The United Kingdom is the largest purchaser of raw jute and before the war was followed by Germany, the United States, France,

Austria-Hungary and Italy. In 1913, for instance, the United Kingdom imported over 350,000 tons valued at £9,246,598, nearly all from India, of this about 130,000 tons was re-exported as raw jute and valued at £3,475,298. During the 1913-14 season, the total export from India was 768,451 tons, of which the United Kingdom took 290,369 tons, Germany, 158,380 tons and the United States 117,744 tons. The export of raw jute has fallen off considerably since then, the total export for 1918-19 being 398,146 tons.

In addition to raw jute India exports large quantities of gunny cloth and gunny bags. In 1913-14 over a thousand million yards of cloth were exported, the United States taking over 70% and the Argentine over 15%. The figures for 1918-19 are very similar, except that the United Kingdom took nearly as much as the Argentine.

During the 1913–14 season 368,759,260 gunny bags were exported of which Australia and New Zealand together took nearly 79 million, the United States 58 million, Chili 36 million and the United Kingdom 27 million. In 1918–19, the total export was over 583 million bags, of which Australia and New Zealand again took 79 million, the United States 46 million, the United States 46 million, Chili 43 million while the United Kingdom imported no fewer than 135 million and Egypt 82 million. The imports into the last two countries doubtless included large quantities of sand-bags in the latter year.

INK FOR WRITING ON ZINC LABELS.

THE following recipe for an ink which can be used for writing on zinc labels is published for information.

This ink has been prepared and tested locally with satisfactory results and has been found an efficient substitute for the more laborious methods of either painting or stencilling.

	Ozs.	Drs.
Verdigris ...	0 ...	2
Sal-ammoniac ...	0 ...	2
Lampblack ...	0 ...	1
Water ...	4 ...	—

The ingredients are mixed in a mortar, the water being added gradually. The ink should be kept in a glass stoppered bottle and applied with a quill pen. Previous to writing the zinc should be polished with a little fine emery paper.

This recipe was obtained from "Recipes for the Colour, Paint Varnish, Oil, Soap and Drysaltery Trades" published by Scott, Greenwood & Son, London.

Abstract of Meteorological Readings in the various Districts of Malaya for the month of May, 1922.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum	Minimum	Range	Mean Wet Bulb	Vapour Tension.	Dew Point	Humidity			
Kelantan, Kota Bahru	...	144.61	83.2	91.7	74.6	17.1	77.3	.820	73.3	72%	...	8.31	2.22
Pahang, Kuala Lipis	...	...	81.4	90.6	71.5	19.2	76.6	...	...	...	...	6.87	3.19
Johore, Johore Bahru	...	...	...	89.1	73.9	15.2	...	...	...	...	...	5.28	1.49
Singapore, Kandang Kerbau	1013.2	...	82.5	83.7	78.2	5.5	75.1	.917	...	85.	Calm.	14.08	4.92
Malacca, Durian Daun	1017.5	122.	83.	89.	74.	15.	79.	.925	...	80.	N. W.	6.18	2.08
Negri Sembilan, Seremban	...	156.4	80.1	91.6	75.	16.6	75.3	.791	73.	75.9	N. W.	4.19	1.45
,, Kuala Pilah	...	153.1	83.	91.3	71.6	19.7	78.7	.896	75.9	80.2	...	2.68	.92
,, Port Dickson	...	160.9	83.8	89.9	75.7	14.2	79.9	.898	75.9	77.4	...	3.68	.78
Selangor, Kuala Lumpur	...	148.8	83.0	90.5	74.0	16.5	77.3	.830	73.5	73.	S. E.	6.23	1.94
,, Klang	...	...	81.7	86.5	74.8	11.7	77.3	...	...	...	...	3.22	1.20
,, Kuala Selangor	...	...	...	90.0	70.0	20.0	...	...	...	...	...	4.03	1.20
,, Rawang	...	...	...	...	...	...	...	...	...	...	...	...	...
Perak, Telok Anson	...	...	81.94	93.	70.	23.	78.18	.914	...	85.	...	4.64	1.41
,, Ipoh	...	...	81.79	95.	70.	25.	76.92	.862	74.51	80.	...	6.85	2.00
,, Taiping	...	...	82.20	93.	71.	22.	77.43	.878	...	81.	...	23.93	3.62
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	38.93	7.99
,, Parit Buntar	...	...	82.79	92.	71.	21.	78.42	.915	...	83.	...	12.12	2.79
Penang, George Town	1009.3	153.	81.3	94.	70.	24.	78.6	.912	73.	88.7	N. W.	12.93	2.32
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	18.61	3.89
Perlis, Kangar	...	...	..	88.7	74.	14.7	...	...	...	...	...	9.34	1.70